11-4-85

THE HOLT MANUFACTURING CO.

[INCORPORATED]

OF

STOCKTON, CALIFORNIA, U. S. A.

SAN FRANCISCO, CAL.
WALLA WALLA, WASH.

LOS ANGELES, CAL.
SPOKANE, WASH.

TRACTION ENGINE DEPARTMENT

BULLETIN NO. T. E. 37 ESTABLISHED 1890 JANUARY, 1910

HOLT CATERPILLAR HOLT

"Lincoln emancipated the slave; Edison emancipated the mule, and Benj. Holt emancipates the horse."

Miles C. Moore,
Ex-Governor of Washington.

CATERPILLAR

1910

GASOLINE TRACTORS

DEVELOPMENT.

During the winter of 1905, our president, Mr. Benjamin Holt, equipped a Holt Bros. Standard Farm Steam Traction Engine with platform or caterpillar wheels, and proved the value of his idea on one of the islands reclaimed from the San Joaquin river, some few miles west of Stockton. This was the first embodiment of his invention conceived several months before.

Experience with several steam engines of the caterpillar type solved, one after another, the peculiar problems involved in designing, building and operating a wheel of this kind.

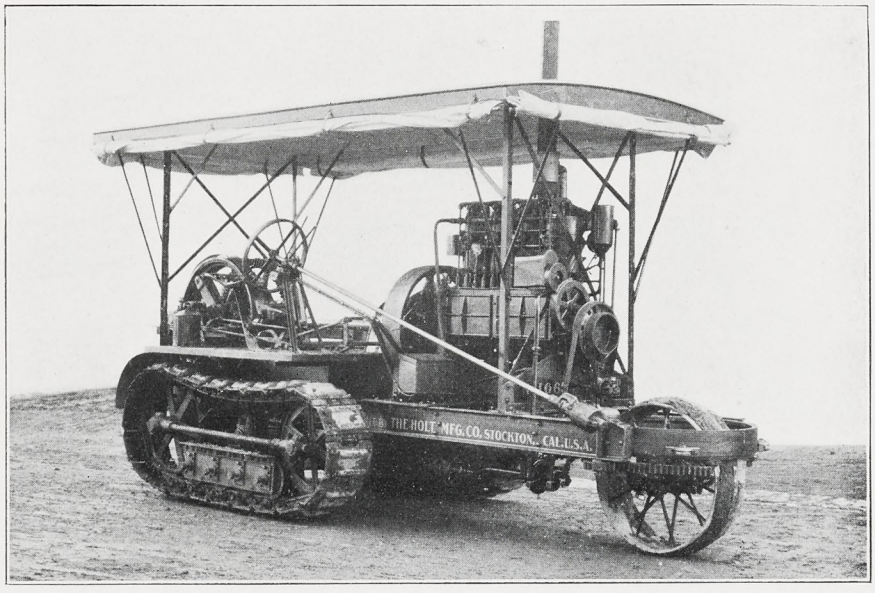
In the fall of 1906, we built our first Gasoline Caterpillar Traction Engine, No. 1001. A year and a half of experience with No. 1001 resulted in No. 1002.

While the engineers, who are supervising the construction of the great aqueduct for the City of Los Angeles, were seeking a solution for their difficult problem of transporting material and supplies from the railroad to the line of the aqueduct, they learned of Mr. Holt's invention, and in September, 1908, purchased No. 1003. So efficient did No. 1003 prove, that after two months' use they were able to convince the Board of Public Works of the City of Los Angeles that it was greatly reducing the cost of transportation and they bought two more, and after several months' trial 25 more.

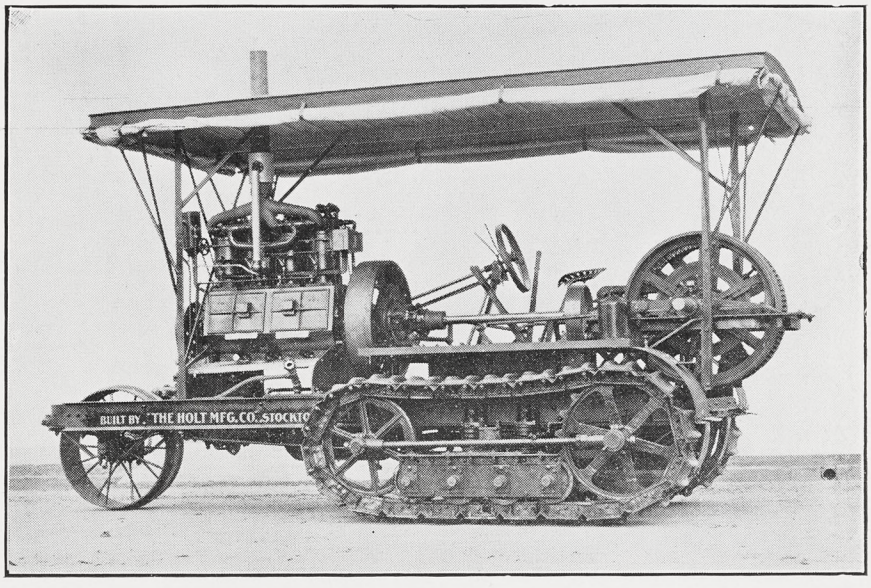
In the meantime, others began to learn of the great economy of the Caterpillar, so that at this date more than 100 are in actual operation—plowing, harvesting and freighting.

COMPARISON.

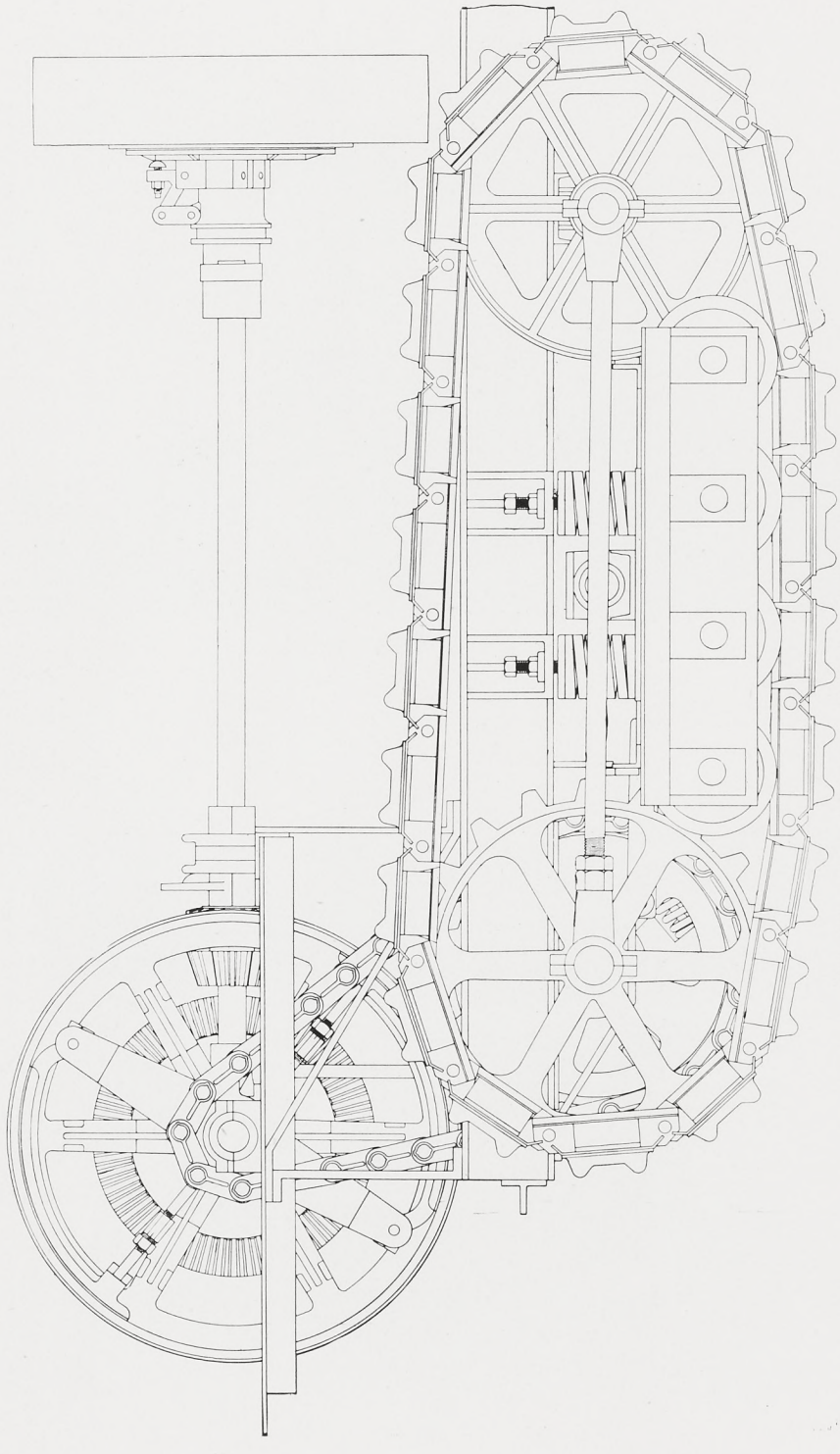
The advantages of the gas engine, as a source of power, were recognized many years ago and many bright minds began to devise methods of using it to propel traction engines. Whatever excellencies the different designs may have had, all had the prime defect of lacking sufficient tractive surface and of the consequent slipping of the wheels on soft and wet land. After witnessing the failure of gasoline traction engines, one after another, at a State Fair contest, a prominent manufacturer of such tractors remarked to the Expert on Farming Machinery from the United States Government Department of Agriculture, "Some one has got to invent a wheel that will plow." This the platform or caterpillar wheel will do, and more.



Right Side, 1910 Model—30 Horse.



Left Side, 1910 Model—30 Horse.



Side Elevation of Platform Wheel and Transmission.

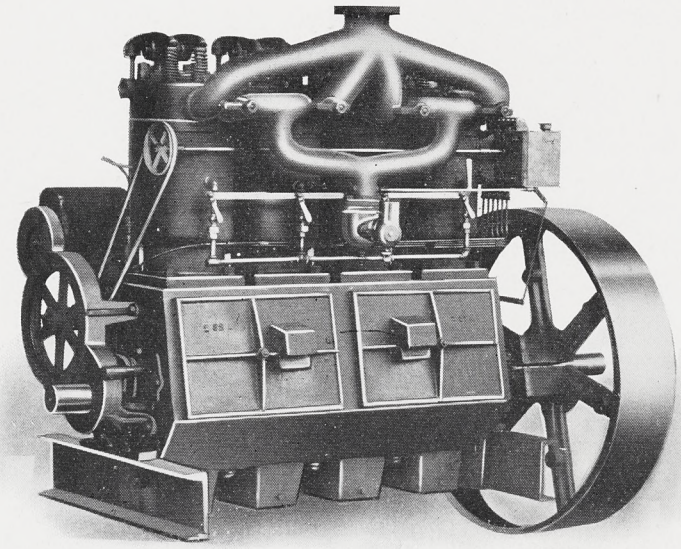
Having the tractive surface of a wheel 184 feet in diameter, without the excessive weight of such a monstrous round wheel, our Gasoline Caterpillar is able to pull its full quota of plows or wagons all the time without slipping its wheels, packing the ground or tearing up the road.

It will work where any other traction engine is practical, and besides that, will work on land too soft for any other engine—on land much too soft for horses. It will operate over any condition of roads, except those made up of boulders and nigger-heads.

PLATFORM WHEEL.

The weight of the traction engine is carried principally by two trucks, each of which has four wheels running on a track. (See cut on opposite page). This track is made of steel links and is, in fact, an endless chain which passes over two sprockets, front and rear—the rear one being the driver and the front one a blank sprocket (without teeth) acting merely as an idler. The truck wheels run on the inside of the track chain, while on the outside of each link is a broad plate shod with a pressed steel corrugated shoe. These plates and shoes support the track chain as wooden ties support a railroad track and form the tractive surface, which enables the engine to work on soft ground and gives it its great power at the drawbar.

In fact, the platform wheel may be compared to the geared locomotives running on cogged tracks, which are used by some railroads where excessive grades are found. The drive sprocket at the rear corresponds to the gear on the locomotive. The links of the track chain correspond to the cogs of the railroad track. The shoes on the track chain having a good "bite" on the ground keep the chain from moving on the ground when the sprocket turns, just as the ties of the cogged track keep the track from moving when the gear of the locomotive revolves; and just as the gear of the locomotive rolls forward on the cogged track carrying the locomotive and train with it, so the sprocket of the caterpillar rolls forward on the chain carrying the tractor and the plows, harvester or wagons with it. But here the comparison stops. For a cogged track must be laid the whole length of the road the geared locomotive is to travel on, while the caterpillar is continually picking up its track chain behind and laying it down again in front. It lays its own track; it carries its track with it wherever it goes; and so, is able to go almost anywhere.



The Gas Engine—Left Side—45 HP.

GAS ENGINE.

As there was no **Gas Engine** on the market suitable for heavy traction service, we were compelled to design one to meet the conditions under which it has to work. It is known as the **Aurora Gas Engine,** and has been more than a success from the first. Our 1910 Gas Engine has an increased capacity and several improvements in the way of refinements of a minor nature have been made, the general design remaining the same.

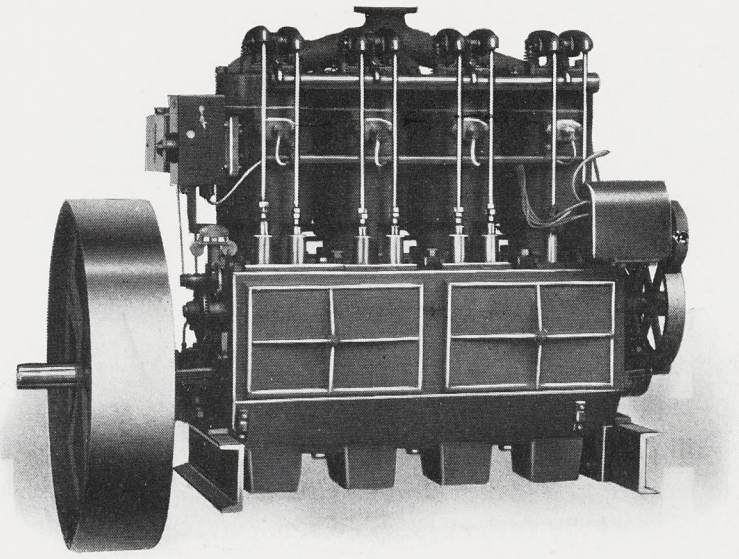
It is designed for using **No. 1 Engine Distillate** and will work with either **Distillate or Gasoline.**

It is of the four-cylinder, four-cycle, water-cooled type, with $6\frac{1}{2}$-in. x 8-in. cylinders, and develops 45 HP at 550 RPM.

The **Frame** or **Bed Plate** is cast in one piece, so designed that a connecting rod or piston can be removed without taking off a cylinder or head, or disturbing any other part of the engine.

This bed plate carries five **Bearings** for the crankshaft, of more than ample size ($2\frac{9}{16}$ x $3\frac{1}{2}$), lined with a special bearing metal. These bearings are so designed and constructed that any or all of them may be removed or replaced without removing the crankshaft.

The **Crankshaft** consists of a solid drop forging, carefully and accurately machined and then run in its bearings for several hours before the engine is completely assembled. This insures smooth, well-fitting journals and bearings.



The Gas Engine—Right Side—45 HP.

The **Connecting Rods** are drop forged of "I" beam section. The crankshaft end is accurately machined to gauge and also fitted with a special bearing liner, which can be removed and replaced without removing the connecting rod from the engine. The **Wrist Pins** are fastened in the piston end of the rods and turn in hard bronze bushings in the pistons. They are hollow for lightness, and case hardened to insure wearing quality.

The cast iron **Pistons** carry three snap rings and have five oil grooves. They are lubricated by an Automatic Feed Oiling System and the splash of oil from the crank case.

The **Cylinder Heads** contain the valves and are removable, so that the valves may be easily ground or renewed.

The **Valves** have steel rods, cast iron heads, and hardened steel caps.

The **Jump Spark** System of Ignition is employed, each engine being equipped with both Magneto and Dry Cell Batteries.

The **Circulation** of the **Cooling Water** is effected by means of a centrifugal pump, which forces the hot water through a **Radiator** made of brass tubing with spiral fins. A current of air from a large fan passes around these tubes and cools the water.

The **Carburetor** is fed by gravity from a small tank, which is kept full to the overflow by a plunger pump.

The speed of the engine is automatically controlled by a throttling **Governor.**

The **Fly Wheel** is 34 inches in diameter, with 7½-inch face. The rim is heavy and is machined for use as a drive-pulley. For driving a pump, feed-mill or other machinery, a pulley may be placed on the left end of the counter-shaft.

TRANSMISSION.

The power is transmitted from the flywheel to the **Crankshaft Extension** by means of a **Multiple Disc Friction** and a somewhat flexible mill coupling.

The rear end of the Crankshaft Extension carries a **Double Bevel Pinion** of .50 carbon crucible steel. When this pinion engages the left bevel gear, the traction engine moves forward. When the shaft is shifted so that the pinion engages the right gear, the traction engine moves backward. The **Reverse** is thus accomplished without back gearing or a complicated planetary, either of which consumes a great deal of power.

When the pinion is shifted so as to engage the smaller bevel gear, the engine moves forward at high speed. There is no gearing up for high speed.

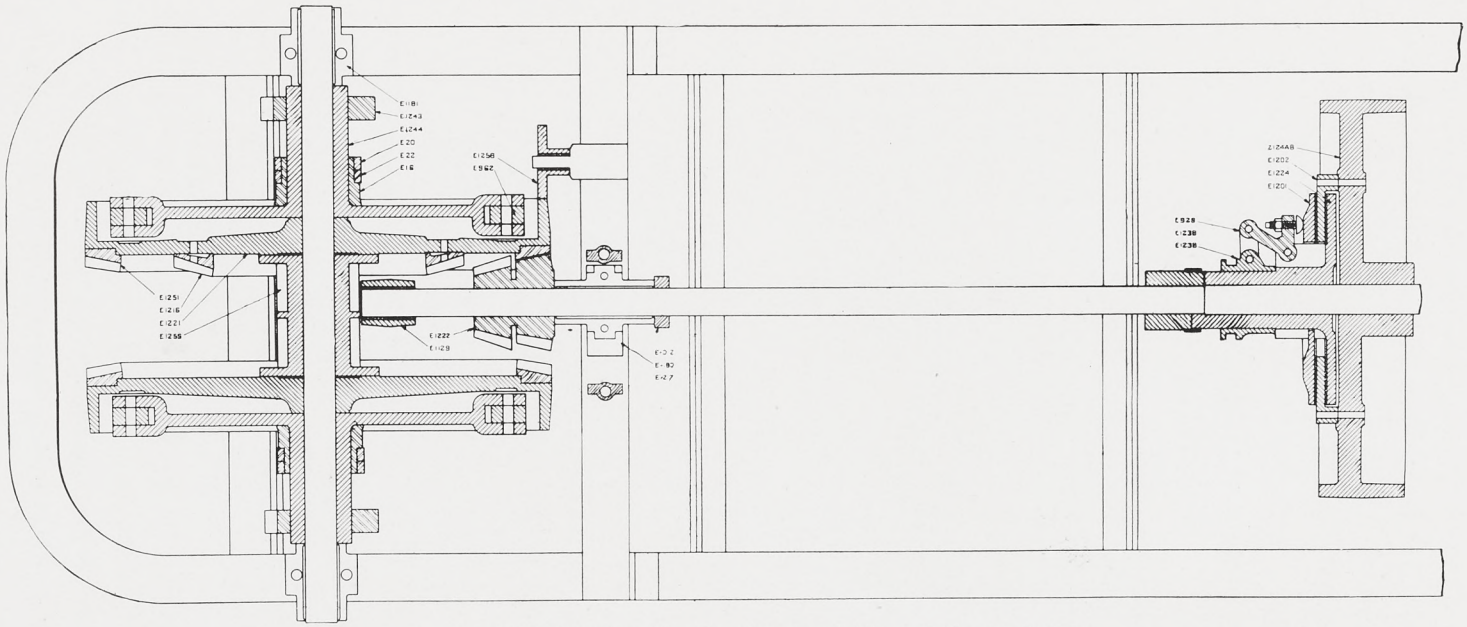
The **High Speed** is approximately five miles an hour.

The **Low Speed** and **Reverse** are approximately 2½ miles an hour.

The **Bevel Gears,** right and left, are riveted to **Female Frictions,** which drive the countershaft. Right and left **Male Frictions** are controlled by independent levers, so that either the right or left wheel may be driven alone or both may be driven at the same speed. This makes it easy to travel in a straight line and make sharp turns, both of which are so desirable in plowing and harvesting.

From the **Male Frictions,** the power is transmitted to the platform wheel shafts (right and left) by means of heavy link belts or **Chains,** the **Sprockets** on the platform wheel shafts being mounted on **"Spring Drivers,"** which relieve the transmission of the shocks due to sudden starting, roughness in the road, and variations in pressure between the different parts of the transmission.

The platform wheel drive **Sprockets** are of cast steel. The **Track Links** are .50 carbon plow steel, rolled especially for this pur-



Line Drawing Showing Sectional View of Transmission.

Simplicity and Directness. The smallest possible number of working parts.

No planetary or back gearing of any kind. Little power lost between motor and drawbar.

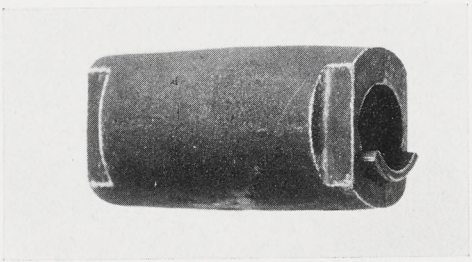
As much power on the reverse as on the forward motion.

No gearing up for high speed.

No gears sliding into mesh. Reversing and changing speed easily and quickly done.

pose. The joints are formed by case hardened **Pins** turning in **Sleeves** of malleable iron lined with hardened steel. The **Plates,** on which the track rests and to which the shoes are fastened, are so designed as to prevent mud and sand from getting into the joints or upon the track. The working life of the track is really much longer than that of the best steel railroad track, and the cost of a new track is no greater than that of new tires for an automobile.

Body Made of Malleable Iron.



Notice the Steel Liner Partly Removed.

Chain Pin Sleeve or Separator Block.

The **Shoes** are pressed steel, corrugated, but not sharp, so that they give the wheels a good bite on soft ground, but will not injure any road or pavement.

The **Truck Wheels** which run on the track are of cast steel and turn on case hardened steel **Gudgeons.** Each one is easily and thoroughly lubricated.

The **Main Beams** of the frame are the heaviest section of 8-inch "I" beam, $4\frac{1}{4}$ inches wide, with a half-inch web. These are thoroughly braced with angles, channels and flat steel braces.

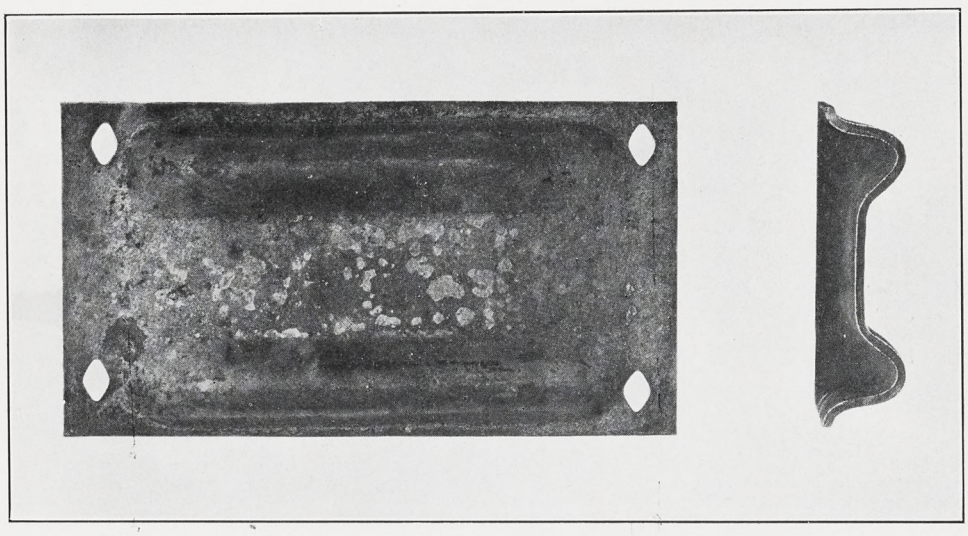
The countershaft is carried on a superstructure made of wide, heavy angle, hot-forged to form, and thoroughly braced with diagonal steel straps.

The frame is mounted on **Springs,** which permit the platform wheels to accommodate themselves to ordinary unevennesses of the field or road, and take up shocks due to the same.

The **Front Wheel** is also spring mounted and is carried in a turntable set with roller bearings.

The **Steering Mechanism** is of the worm and gear locking type, which we have used with such success on our large Steam Traction Engines.

The **Fuel Tank** has a capacity af 70 gallons.



Corrugated Pressed Steel Shoe.

The **Water Tank** has a capacity of 56 gallons and does not need replenishing oftener than once in four or five days.

The **Height** over all is 11 feet, 1 inch.

The **Length** over all is 18 feet, 7 inches.

The **Width** over all is 7 feet.

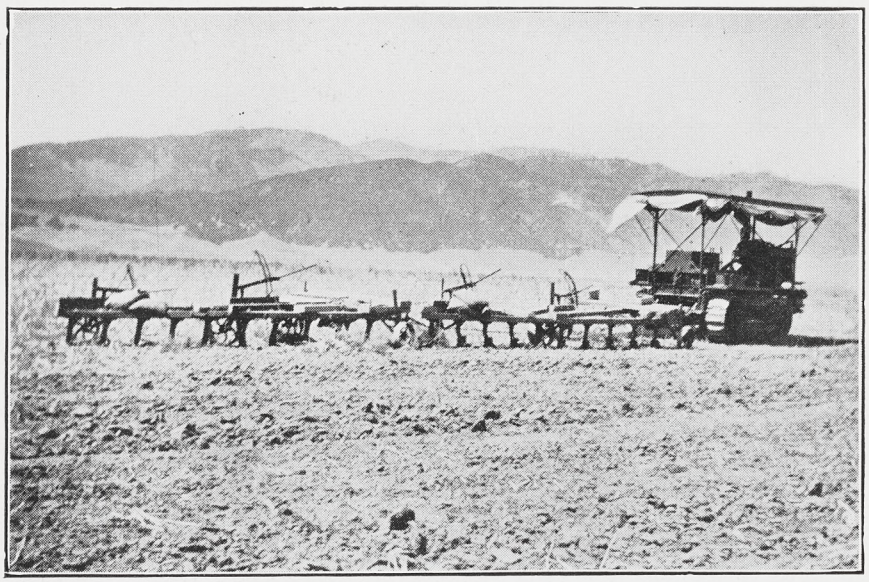
The **Tread** is 82 inches.

The **Weight,** when fully equipped, is 8 tons.

A HOLT PRODUCT THROUGHOUT.

All parts entering into the construction of the Holt Gasoline Caterpillar Engine are made in our own shop, under our direct supervision.

The benefit of our 20 years' experience in Traction Engine building, to meet the most adverse conditions of road and farm, goes into the construction of our new type of engine.



25-Horse Caterpillar Pulling 13 feet 6 inches of Plows.

PLOWING MACHINES.

The great efficiency of the Gasoline Caterpillar Traction Engine, when hauling plows, has been repeatedly demonstrated under a great variety of conditions.

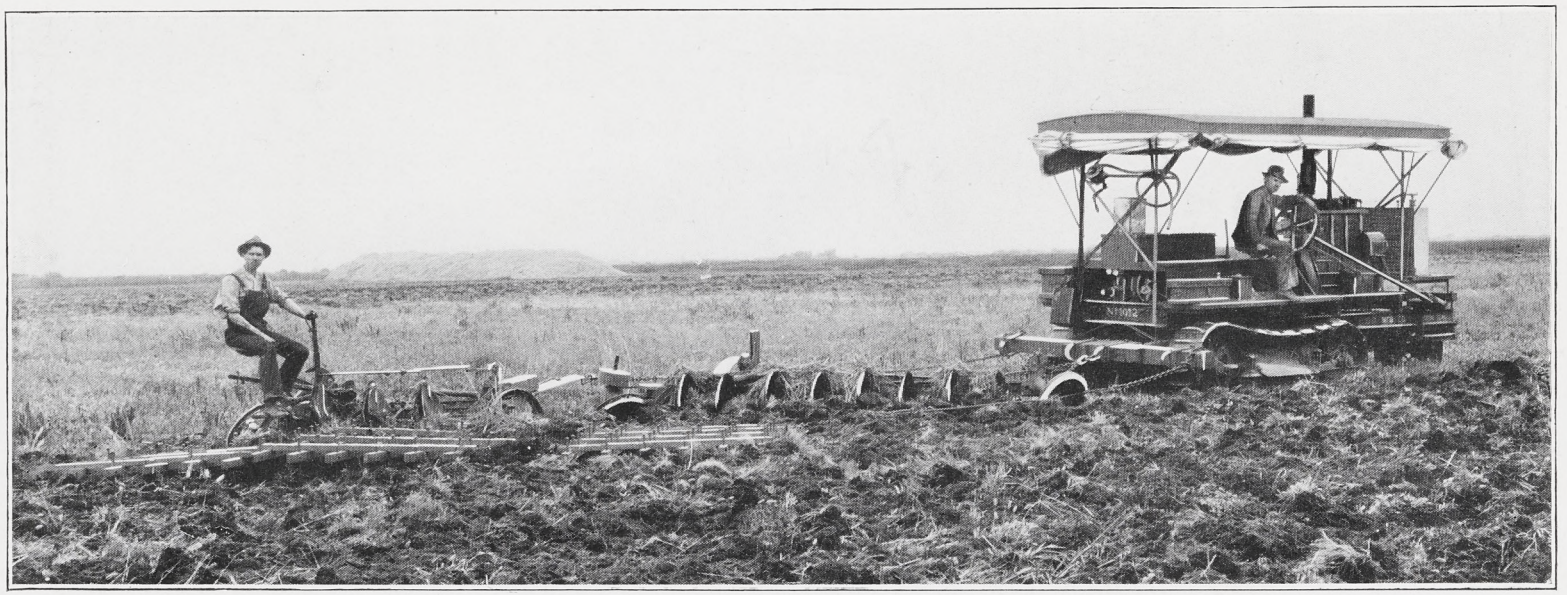
The number of plows the engine is capable of hauling depends, of course, on the nature of the soil and the depth of plowing. It will do as much in a day as thirty horses working under the same conditions would be able to accomplish. Some have used their engines at night as well as by day and so have done as much as could have been done in the same length of time with sixty horses. However, this is a policy which can be recommended only in case a large tract of land must be plowed in a short time.

In working heavy land, ten to twelve inches deep, a strip sixty inches wide has been plowed. On sandy land, 13 feet, 6 inches of plows, running four to six inches deep, have been hauled without great effort. One of our 1910 engines pulled 36 feet of disc harrows on the high speed (5 miles per hour) which is harrowing at the rate of 22 acres per hour.

At any time when the ground is in such condition that the plows will work, this type of engine can be used without packing the ground or getting bogged down.

A GASOLINE TRACTION ENGINE IS ALWAYS READY TO START.

Requires only one man to operate;
Uses little water;
Will not set fire to buildings or grain fields;
Is easier to supply with fuel;
Cheapest to Operate;
Is not troubled by bad water;



25-Horse Gasoline Caterpillar Pulling 11 feet of Plows and Harrows on Tule Reclaimed Land.

A CATERPILLAR TRACTION ENGINE HAS THE GREATEST TRACTIVE SURFACE IN PROPORTION TO ITS WEIGHT.

Least weight in proportion to power; Does not pack the ground; Does not tear up the road; Is practical on very soft or wet ground; Occupies small space on road and bridge; Nearly the full power of the motor available at the drawbar.

A GREAT SAVING.

The following comparison will show the saving that can be effected by one of these outfits:

With horses, plowing costs from $1.25 to $1.50 per acre.

With a Gasoline Caterpillar Traction Engine, the cost is from 30 to 50 cents per acre, and it will plow from 15 to 40 acres per day.

This shows a saving of from $15.00 to $40.00 per day.

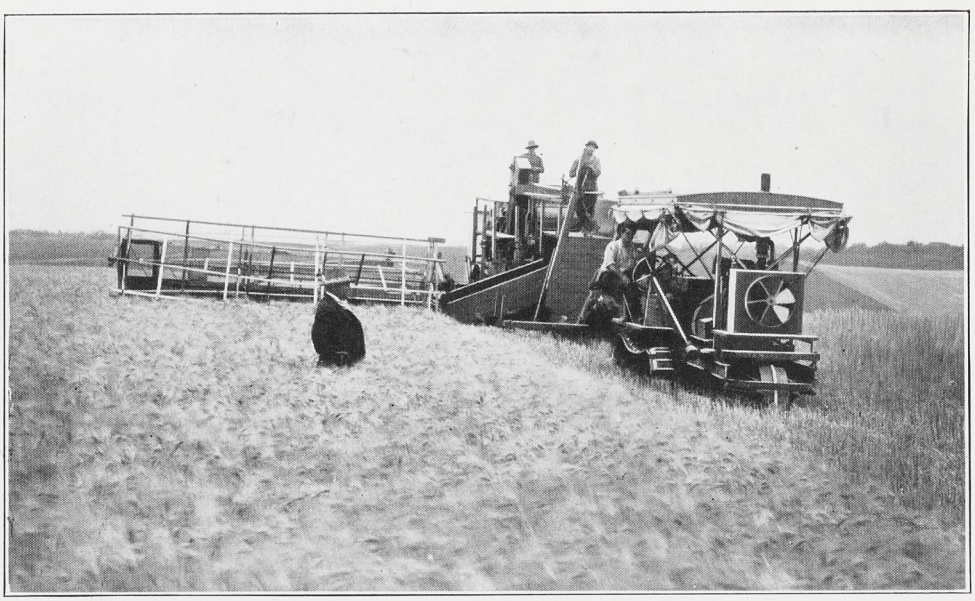
TELEGRAM.

"FALLON, NEVADA, Dec. 28, 1909.

To the Holt Manufacturing Co.,
Stockton, Cal.

Hauled twenty tons over slick, icy road. Engine a marvel.
R. L. DOUGLASS."

NOTE—Mr. Douglass bought his engine for plowing. He used it to run his barley crusher and then hauled twenty tons of the crushed barley sixteen miles to town, as above described.



25-Horse Caterpillar Pulling Holt Junior Side Hill Harvester, 16-foot Cut.

25-Horse Caterpillar Pulling Holt-Holley Harvester, 14-foot Cut.

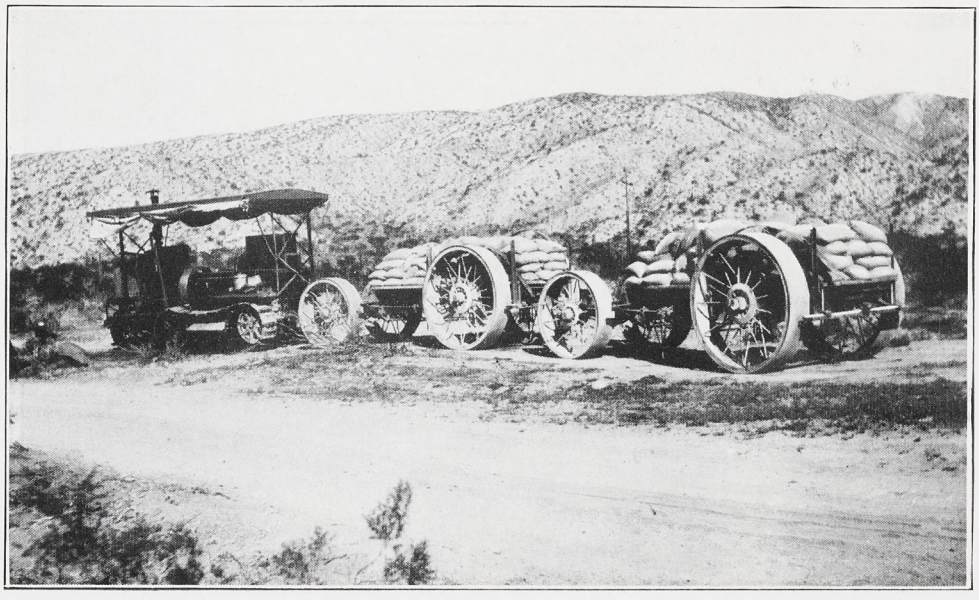
IN THE HARVEST FIELD.

Two seasons' experience with engines which we rated as 25-horse, showed that they were fully capable of doing the work of 30 horses in the harvest fields. Our 1910 model, with its simpler transmission, larger motor and lighter weight, is sure to beat that record. This excess of power insures a steady motion at all times, the essential feature of good separation in the operation of a harvester.

It has been found that the expense of operating a harvesting outfit, consisting of a Gasoline Caterpillar Traction Engine and one of our Combined Harvesters, averages less than 95 cents per acre, including fuel, maintenance and board for crew of four men.

Always ready to start—no horses to be caught and harnessed before the day's work can be begun—no horses to be watered several times a day—no horses to run away, entailing loss of time and money—no horses to be fed during the long intervals between harvest and plowing.

The Caterpillar will plow your fields, pull your harvester, take your crop to market and at odd times pump water, grind feed, saw wood or run other machinery.



25-Horse Caterpillar Hauling 16 Tons of Cement.

FREIGHTING.

For road work, the Caterpillar has no peer. The long tractive surface of the platform wheels, composed, as it is, of corrugated shoes, will not injure any road or pavement. In fact, when pulling a train of our wagons, designed for use with the engine, it is actually a benefit to the road. A few trips across a trackless, sandy plain make a road suitable for automobiles.

As to the economy of the tractor when used for road hauling, we quote from the Fourth Annual Report of the Bureau of the Los Angeles Aqueduct:

> "Wagon haulage from the railroad has been greatly facilitated by the employment of traction engines of the 'caterpillar' type, a style peculiarly adapted to desert conditions. With a capacity of from 5 to 15 tons, depending on the grade, these engines make regular trips to the various camps at an average ton mile cost of 25 cents. It is interesting to compare this figure with the lowest bid received for this work, namely, 80 cents per ton mile.
>
> "Ordinary wagon haul with teams is carried on in connection with the work of the traction engines, distributing the material to the tunnel portals and conduit construction camps at an average cost of 50 cents per ton mile."

Note that the above costs are the average costs. Then read the letter on page 20. During the month of December, 1909, fourteen

25-Horse Caterpillar Hauling 19 Wagons—a Total Load of 53 Tons.

engines did their work at an average cost of 14 cents per ton mile. In many cases the monthly record of single engines has been as low as 10 and even as low as 8 cents per ton mile, and that in the face of bad roads and steep grades.

You can depend upon the tractor to do the work of 30 horses. Of course, the number of tons it can pull depends, in any case, on the character of the road and the grades to be climbed.

On page 17 is a cut taken from a photograph showing a train of 19 wagons, which one of our 25-horse engines pulled at a speed of $2\frac{1}{2}$ miles per hour on a level macadamized street, turning the corners without difficulty. The wagons weigh 5,600 pounds each, making a total load of 53 tons behind the engine.

The loads shown in the other cuts are not nearly so great, the reason being that there were grades and adverse conditions of road to be met with.

The Caterpillar without load has climbed a $62\frac{1}{2}$ per cent grade of soft, loose earth, stopping on the grade and starting again. In practical work it has pulled loads up grades as high as 30 per cent.

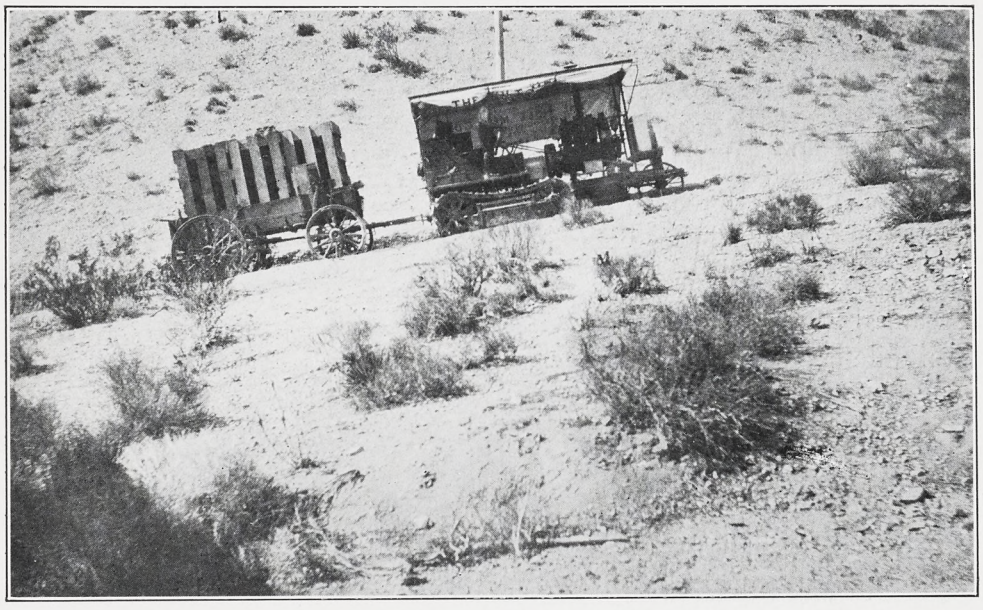
By actual test the cost per HP hour, using distillate at 9 cents per gallon, is less than 1 cent.

One of our Holt Gasoline Caterpillar Traction Engines, operating on the Mojave Desert, on a series of hauls aggregating 113 miles, used 225 gallons of distillate, which would make the fuel consumption per mile less than 2 gallons.

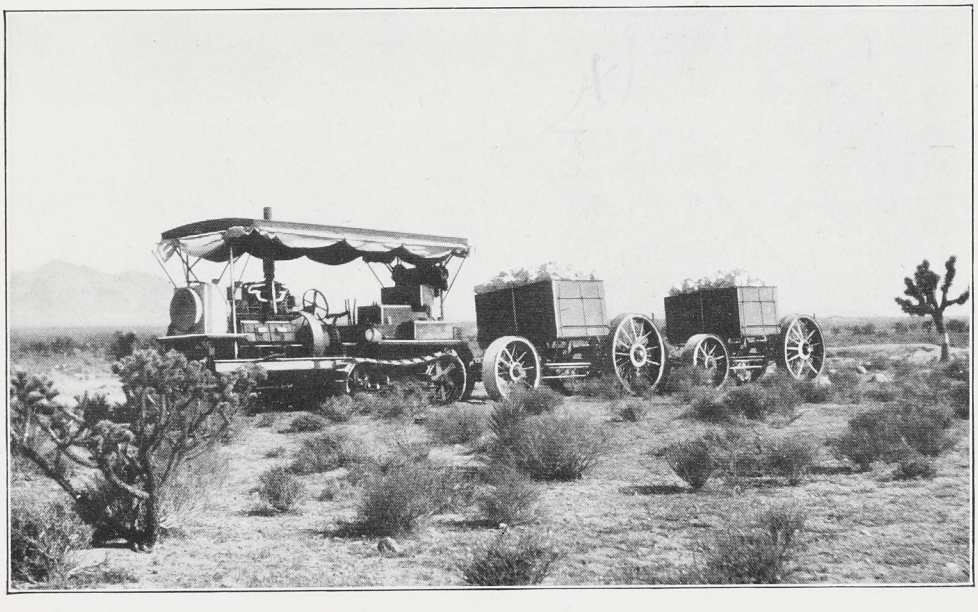
Each engine has a fuel carrying capacity of 70 gallons, and a water carrying capacity of such size that it is unnecessary to take water oftener than once in every 4 or 5 days.

The machine may be maintained at any point on the desert, and ordinary repairs may be made by the engine drivers without the establishment af a machine shop.

All parts of our engines are made to template, so that extra parts may be carried on hand and any ordinary repairs may be made by the engine driver.



25-Horse Caterpillar Hauling an 8-ton Air Compressor—12 Per Cent Grade.



25-Horse Caterpillar Hauling 14 Tons of Rock Across the Desert.

HAULING A STEAM SHOVEL BY GASOLINE TRACTION ENGINES.

From Engineering News, January 20, 1910.

SIR: You may be interested in the following statement regarding the use of traction engines on the construction of the Los Angeles Aqueduct. It is necessary to do a great deal of hauling on the desert and mountain roads, and, for this purpose, traction engines of the Caterpillar type have been used with satisfactory results, particularly in the moving of heavy equipment and machinery.

On the Mojave Division we have just moved a No. 40 Marion steam shovel by traction engines a distance of 31 miles at a very low ton-mile cost. Four engines were used—three on the shovel, which weighed 30 tons, and one on the boom, turn-table and some minor parts which weighed 10 tons. Two specially made trucks carried the principal load. The "Caterpillars" weigh 8 tons and are driven by 40-HP gasoline engines which burn petroleum distillate. The following figures include preparatory work, switching and return of engines to camp, a distance of 22 miles:

Total load	40 tons
Distance	31 miles
Total haul	1,240 ton-miles
Total cost	$175.00
Ton-mile cost	$0.141 per ton-mile
Total time moving shovel	55½ hours
Actual running time	21 hours

The roads over which the engines traveled were good for about 20 miles of the distance. Eleven miles were sandy and bad for ordinary wagon haul. The maximum adverse grade was 8 per cent for about one-half mile; the remainder was quite flat or down hill.

The special feature of this haul is not alone the low ton-mile cost, but the fact that the efficiency of the equipment and of the crews permitted the handling of a 30-ton load in one piece over soft roads, thereby saving the time and expense of dismantling the steam shovel.

The views show the shovel being hauled over rolling country, two of the engines being in the lead and one in the rear for the purpose of holding back.

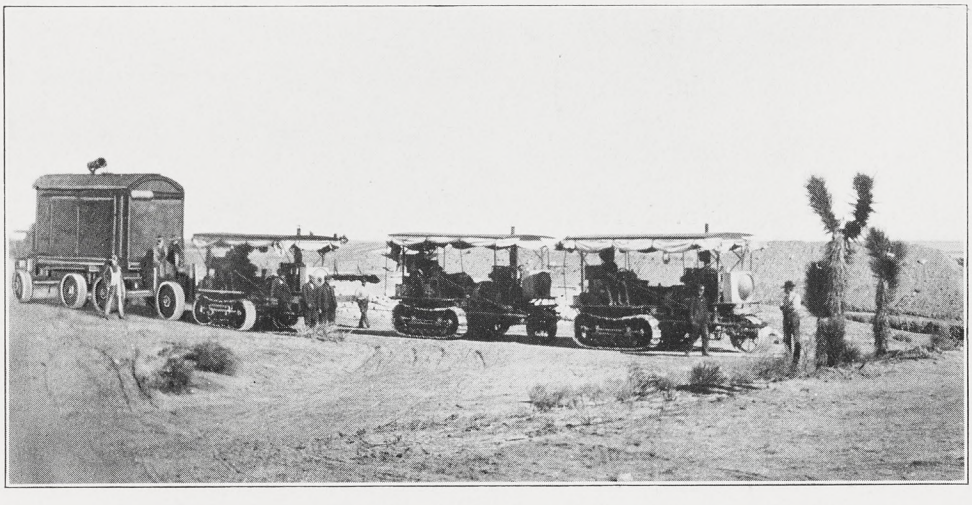
Yours truly,

J. H. ROBINSON,

Division Engineer (Mojave Division).

Los Angeles, Cal., Dec. 13, 1909.

Double Header Crossing the Desert.



Hauling 30-Ton Steam Shovel.

25-Horse Caterpillar Hauling Crushed Rock.

HOLT GASOLINE CATERPILLAR TRACTION ENGINES. DIMENSIONS, WEIGHTS, ETC.

30-Horse Capacity.

Motor—45-HP.

4 Cylinders.

6½-in. Bore of Cylinders.

8-in. Stroke.

550 Revolutions per Minute.

No. 1 Engine Distillate used as Fuel.

1½ to 3½ Gallons Consumed per Hour.

70 Gallons—Distillate Tank Capacity.

56 Gallons—Water Tank Capacity.

18 Feet 4 Inches Long, over all.

7 Feet Wide, over all.

11 Feet 1 Inch High, over all.

82 Inches Width of Tread.

8 Tons Weight When Fully Equipped.

PURCHASERS OF HOLT GASOLINE CATERPILLAR TRACTION ENGINES FOR THE YEAR 1909.

Los Angeles Aqueduct, Los Angeles, Cal.—28 Engines, 94 Wagons

Lamb, Hickey & Don Ray, Stockton, Cal.—Engine and Plows

Kern Trading and Oil Co., Flood Building, San Francisco, Cal.—Engine and 2 Wagons

Imperial Water Co. No. 1, Imperial, Cal.—2 Engines

Crocker-Huffman Land and Water Company, Merced, Cal.—3 Engines and Plows

D. K. McDonald, Wilson Creek, Wash. —Engine and Plows

John Paget, Lamoine, Washington - —Engine

Sonoma Land Co., Shellville, Cal. - - —Engine and Plows

Jones & Kerr, Tehachapi, Cal. - - —Engine

Union Oil Co., Los Angeles, Cal. - - —6 Engines, 16 Wagons

C. Bolte, Honolulu, T. H. - - - —Engine and Wagon

C. A. Canfield, Angiola, Cal. - - - —Engine

Frank Barnard, Sawtelle, Cal. - - —Engine and Plows

Ventura Farming Co.. Ventura, Cal. - —Engine and Plows

American Beet Sugar Co., Oxnard, Cal. —Engine and Plows

J. L. Freeman, Madera, Cal. - - - —Engine

Orchard Home Co., Tolo, Oregon - —Engine and Plows

Walker Bros., King City, Cal. - - —Engine

Cunningham Corporation, Le Grand, Cal. —Engine and Plows

R. L. Douglass, Fallon, Nevada - - —Engine

John Borchard, Oxnard, Cal. - - - —Engine

Jas. Leonard & J. B. Dawley, Oxnard, Cal.—Engine and Plows

Huasteca Petroleum Company, Tampico, Tamaulipas, Mexico—2 Engines, 4 Wagons

Cerf Rosenthal, Hardwick, Cal. - - —Engine and Plows

MANUFACTURING DEPARTMENTS.

Drafting Dep't.	Traction Eng. Shop	Sheet Iron Shop
Photographic Dep't.	Boiler Shop	Screen Shop
Pattern Shop	Planing Mill	Sickle Bar Department
Foundry	Wheel Dep't.	Electrical Shop
Machine Shop	Draper Dep't.	Tin Shop
Light Forge Shop	Paint Shop	Scraper Department
Heavy Forge Shop	Construction Dep't.	Printing Department

The Plant—Covers 16 Acres of Ground.

BUILDERS OF

Holt Regular Farming Traction Engines.....Catalogue L
Holt Regular Freighting Traction Engines.....Catalogue L
Holt Steam Combined Harvesters.....Catalogue L
Holt Steam Caterpillar Traction Engines.....Bulletin TE 31
Holt Gasoline Caterpillar Traction Engines.....Bulletin TE 37
Holt Traction Engine Plows.....Bulletin P 33
Holt Freighting Wagons or Trucks.....Bulletin TE 34
Holt Side Hill Combined Harvesters.....Bulletin H 36